Exhibit A: Translation of JP 09310236 A

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(54) (TITLE OF THE INVENTION) Flame retardant plied thread and fabric with a unique appearance using same

(57) (ABSTRACT)

(PROBLEM) Offering a silk-like fabric that has a unique appearance with high design characteristics, woven or knit from thread made from dull threads and bright threads twisted together.

(MEANS FOR SOLVING) A silk-like fabric using two- or three-ply thread made from intertwined dull threads made from a spun thread of halogen-including fibers containing a flame retardant chemical, and bright threads made from

polyester, mercerized cotton, or the like in the weft, the warp, or both weft and warp; by using a thread that combines dull threads and the bright threads in weaving, dull portions and the bright portions appear alternately on the surface of the silk-like fabric, giving a unique appearance with high design characteristics as well as a high degree of flame retardance.

(SCOPE OF PATENT CLAIMS)
(CLAIM 1) A plied thread made by combining and spinning a dull single thread made from spun threads of halogen-including fibers including a flame retardant chemical at 5–60% by weight with antimony oxide as its main constituent, and a bright single thread made from either a spun thread of polyester filament or a spun thread of mercerized cotton.
(CLAIM 2) A plied thread as described in Claim 1 with a twist factor K of 2.5–4.5 and a retwist rate of 10–90% for said single dull thread and single bright thread.
(CLAIM 3) A plied thread as described in Claim 1 with a twist factor K of 2.5–3.0 and a retwist rate of 10–50% for said single dull thread and single bright thread.
(CLAIM 4) A fabric structured using a plied thread made by combining and spinning a dull single thread made from spun threads of halogen-including fibers including a flame retardant chemical at 5–60% by weight with antimony oxide as its main constituent, and a bright single thread made from either a spun thread of polyester filament or a spun thread of mercerized cotton as the warp, the weft, or both warp and weft.
(CLAIM 5) A fabric as described in Claim 4 with a twist factor K of 2.5–4.5 and a retwist rate of 10–90% for said single dull thread and single bright thread.
(CLAIM 6) A fabric as described in Claim 4 with a twist factor K of 2.5–3.0 and a retwist rate of 10–50% for said single dull thread and single bright thread.
(DETAILED DESCRIPTION OF THE INVENTION)
(0001)
(TECHNICAL FIELD OF THE INVENTION) This invention relates to a plied thread that includes a flame retardant, and to fabric that includes a flame retardant and has a unique appearance giving it excellent design characteristics, and this fabric is suitable for use in flame-retardant clothing, sweaters, chair covers and the like.
(0002)
(PRIOR ART) Conventionally methods have been offered to give the surface of fabric a three-dimensional appearance by weaving plied thread or thread wherein single threads of different materials and single threads of different heat constriction rates are aligned. However, there have conventionally been no fabrics with rich design characteristics as well as a high degree of flame retardance.
(0003)
(PROBLEM TO BE SOLVED BY THE INVENTION) Taking into consideration the above conditions, the purpose of this invention is to offer a fabric with a unique exterior appearance and high design characteristics in addition to a high degree of flame retardance.
(0004)
(MEANS FOR SOLVING THE PROBLEM) To attain the purpose of this invention, the inventors, as the result of continued and thorough study, discovered that it was possible to make a fabric that had a unique appearance with high design characteristics as well as a high degree

of flame retardance by using a plied thread that included a dull thread that represses the gloss of the flame retardant chemical and a bright thread with a gloss for the weft, the warp, or both weft and warp of the fabric.

(0005) For said dull thread, a spun thread of fibers that include a halogen-including flame retardant chemical at 5–60% by weight with antimony oxide as its main constituent, and for said bright thread using a polyester filament or spun thread, or a spun thread of mercerized cotton is desirable, but rayon or a modacryl with a strong bright feel may also be used.

(0006) The twist factor K of the thread is determined by the thread size, but there is the problem that if it is made too high it will become hard, and become a fine low-weight thread, and also there is the problem that if it is too low, the spinning characteristics deteriorate, it will not form a thread, and its properties will be greatly reduced. Also, when not wound tightly, generally the difference in sheen between the dull thread and the bright thread becomes apparent making it easier to attain a unique appearance with high design characteristics. For this reason, it is desirable to make the twist factor K of the single threads of said dull thread and bright thread 2.5–4.5, with 2.5–3.0 more desirable.

(0007) Further, generally, the retwist rate of thread is normally 80–90%; when not wound tightly, generally the difference in sheen between the dull thread and the bright thread becomes apparent, making it easier to attain a unique appearance with high design characteristics. For this reason, the desirable retwist rate when the mixed thread made when said dull thread and bright thread are wound together is 10–90%, while a more desirable retwist rate is 10–50%.

(0008) The fabric involved in this invention is constructed using the previously mentioned plied thread as at least the weft or the warp, that is to say, either the weft or the warp, or as both weft and warp. The construction of the fabric in this case may be flat, twill, satin, dobby pattern, or jacquard pattern, however optimally the satin construction is desirable. This fabric has the stipulated flame retardance, and a unique exterior appearance with high design characteristics.

(0009)

(EMBODIMENTS OF THE INVENTION) This invention is explained detail below.

(0010) The dull thread is the thread that reduces the sheen, and, dependent upon the degree the sheen is reduced, there are semi-dull threads, full-dull threads, etc. The dull thread used in this invention is spun thread of fiber that includes a halogen-including fire retardant chemical that has as its main constituent antimony oxide at 5–60% by weight. Optimally said halogen-including fibers are made up of a copolymer made from acrylonitrile at 40–70% by weight, a halogen-including monomer at 60–30% by weight, and a monomer including a sulfonate base at 0–3% by weight. With acrylonitrile at less than 40% by weight the heat resistance is insufficient, and when the acrylonitrile exceeds 70% by weight the flame retardance does not have sufficient effect. Said halogen-including monomers include halogen-including vinyl monomers and halogen-including vinylidenes such as vinyl chloride, vinylidene chloride, vinyl bromide etc., and from among these one, two, or

more types may be used. When the halogen-including monomer is at than 30% by weight sufficient flame retardance will not be attained, and when the halogen-including monomer exceeds 60% by weight the heat resistance is insufficient. Further, as examples of said monomer including a sulfonate base can be given sulfonate, methacryl sulfonate, allyl sulfonate, styrene sulfonate, 2-acrylamide-2-methylpropane sulfonate, and cholides (for instance potassium chloride, ammonium chloride, etc.). The sulfonate-including monomer is to be used as needed, but when it exceeds 3% by weight, spinnability is reduced.

(0011) Also, as examples of the antimony oxide included in said halogen-including fibers as flame-retardant chemicals can be given antimony trioxide and antimony pentoxide. This antimony oxide are required to be included at 5–60% by weight in the halogen-including fibers, and at less than 5% by weight the flame retardance effect is insufficient, while exceeding 60% by weight causes a significant deterioration of the fiber production process (for instance nozzle obstruction and rising pressure) and significant decrease in properties. Further, as previously noted, antimony oxide is the optimum flame resistant chemical, but of course it is all right to use antimony oxide along with a flame resistant chemical other than antimony oxide. Flame resistant chemicals other than antimony oxide include oxides such as organic bromide combinations, tin, zirconium, aluminum, etc., as well as hydroxides.

(0012) Next, the bright thread is a thread with a sheen, and in this invention polyester filaments as well as spun threads and cotton thread given a sheen through mercerization process are suitable, but rayon, modacrylic fibers with a bright feel, or the like are also acceptable.

(0013) In this invention, to give the exterior of the fabric a unique appearance with high design characteristics, the dull thread which reduces the sheen and the bright thread which has a gloss are single threads that are combined and spun, and this thread is used as at least the weft or the warp of the fabric. Further, by setting the conditions of the plying in the prescribed manner, the design characteristics improve. The twist conditions set the twist factor K of the single threads (K = t (number of twists per inch)/ $\sqrt{\text{Nc}}$ (English style cotton count)) at 2.5–4.5, and optimally at a loose wind of 2.5–3.0, and also when combining said dull thread and bright thread into a combined thread, the retwist rate (100 × the upper number of twists / lower number of twists) is 10–90%, and optimally intertwined at 10–50%. Further, the plied thread in this case, may be made of both said single dull thread and the single bright thread aligned so that there is one of each in the combined thread, or with two of one and one of the other in three strands.

(0014) The above double thread or triple thread will be at least the weft or the warp of the fabric (that is to say, either the weft or the warp), or they can be used as both weft and warp, but optimally many are used so that the dull threads and the bright threads appear on the surface of the fabric to obtain a unique appearance with high design characteristics. Also, it is acceptable to freely change the distribution by using a regular mixed thread of only dull stands or bright threads that alternate the dull threads and bright threads, every two

strands, etc. Also, the construction of the fabric in this case may be flat, twill, satin, dobby pattern, or jacquard pattern, but a construction similar to satin in which the intersections between the weft and the warp are few is optimal.
(0015)
(EXAMPLES OF EMBODIMENT) Below, we describe in detail this invention through examples of embodiment, but this invention is not limited to these examples of embodiment. Further, assessment of the fire retardance of this fabric was implemented using the JIS L 1091 A-1 method. Passing standards for flame retardance are shown in the following table.
(0016)
(TABLE 1)
Table 1. Flame Retardance (JIS L 1091 A-1 Method)

Measurement Items	Acceptance Standards
Residual flames (sec)	3 or less
Residual burning (sec)	5 or less
Singed area (cm^2)	30 or less
Singe length (cm)	20 or less

(0017) Also, a visual evaluation of the design characteristics of the fabric was carried out. For the evaluation standard, "○" means design characteristics are high, "△" means design characteristics are low and "×" means there are no design characteristics.
(0018) (Example of Embodiment 1) For the weft were prepared two types of single threads: a double thread with a changed retwist rate formed by spinning (twist factor K = 3) a regular polyester filament of 200 d (denier) and a halogen-including 20/1 spun thread including antimony trioxide at 9% by weight; and a single thread of regular polyester filament 200 d. As the warp was prepared a 10/1 spun thread of halogen-including fiber that contained antimony trioxide at 9% by weight. We produced five types of fabric with the standards shown in Table 2 below using said weft and warp. Next the fabrics were finished using common dyes. Finally, in the table "PET" indicates the regular polyester filament, and "MAN" indicates said spun thread of halogen-including fiber.
(0019)
(TABLE 2)

Table 2

	Fabric standards weft type × warp type density (twists/inch) × density (twists/inch) (fabric construction)	Weft retwist rate	Flame Resistance (JIS L 1091 A-1 Method)					Design characteristics
			seconds Residual flame	seconds Residual burn	cm^2 Single area	cm Singe length	Assessment	
Comparative Example 1	PET MAN 200 d × 10/1 130 × 42 (satin weave)	100	0.4	0	5.2	2.7	Pass	×
Example of Embodiment 1	PET MAN MAN 200 d/20/1 × 10/1 100 × 42 (satin weave)	81	0	0	4.1	2.5	Pass	△
Example of Embodiment 2	PET MAN MAN 200 d/20/1 × 10/1 100 × 42 (satin weave)	47	0	0	3.8	2.4	Pass	○
Example of Embodiment 3	PET MAN MAN 200 d/20/1 × 10/1 100 × 42 (satin weave)	19	0	0	4.1	2.6	Pass	○
Comparative Example 2	PET MAN MAN 200 d/20/1 × 10/1 100 × 42 (satin weave)	0	0	0	4.2	2.6	Pass	×

(0020) As is clear from the results in Table 2, the examples that used a double thread spun at the stipulated retwist rates from a dull thread made from spun thread of halogen-including fiber and a bright thread made of regular polyester filament are fabrics that have unique appearance with high design characteristics.

(0021) (Example of Embodiment 2) As the weft were prepared a double thread with a changing retwist rate containing 20/1 cotton spun thread and a 20/1 spun thread of halogen-including fiber that contains antimony trioxide at 30% by weight; and a 20/1 cotton single thread. As the warp was prepared a spun thread 10/1 of halogen-including fiber containing antimony trioxide at 30% by weight. We produced five types of fabric of the standards shown in Table 3 below using said weft and warp. Next, after giving cotton a sheen through use of the mercerization process, the fabrics were finished using common dyes. The assessments of the fabrics we obtained are shown in table 3. Finally, in the table "CO" indicates cotton, and "MAN" indicates spun thread of halogen-including fiber.

(0022)

(TABLE 3)

Table 3

	Fabric standards weft type × warp type density (twists/inch) × density (twists/inch) (fabric construction)	Weft retwist rate	Flame Resistance (JIS L 1091 A-1 Method)					Design characteristics
			seconds Residual flame	seconds Residual burn	cm^2 Single area	cm Singe length	Assessment	
Comparative Example 3	CO MAN 20/1 × 10/1 80 × 49 (twill weave)	100	0.6	2.6	20.3	5.2	Pass	×
Example of Embodiment 4	CO MAN MAN 20/1/20/1 × 10/1 60 × 49 (twill weave)	87	0	0.9	12.0	4.2	Pass	△
Example of Embodiment 5	CO MAN MAN 20/1/20/1 × 10/1 60 × 49 (twill weave)	50	0.2	1.0	12.3	4.1	Pass	○
Example of Embodiment 6	CO MAN MAN 20/1/20/1 × 10/1 60 × 49 (twill weave)	25	0.4	1.0	11.1	3.9	Pass	○
Comparative Example 4	CO MAN MAN 20/1/10/1 × 10/1 60 × 49 (twill weave)	0	0.5	1.4	14.0	4.3	Pass	×

(0023) As is clear from the results in Table 3, the examples that used a double thread spun at the prescribed retwist rate using a dull thread made from a spun thread of halogen-including fiber, and a bright thread made from mercerized cotton spun thread have a unique appearance with high design characteristics.

(0024)

(EFFECT OF THE INVENTION) As shown above, with this invention, by constructing a fabric using a plied thread spun from a single dull thread made from a spun thread of halogen-including fiber containing a flame retardant chemical at 5–60% by weight with antimony oxide as its core constituent, and a single bright thread made from a filament or spun thread of polyester, or a spun thread of mercerized cotton as at least either the weft or the warp, a fabric is offered that has a unique appearance with high design characteristics, as well as a high degree of flame retardance.